Group lending and the role of the group leader

Eijkel, Remco van; Hermes, Niels; Lensink, Robert

Group Lending and the Role of the Group Leader: Theory and Evidence from Eritrea

Remco van Eijkel, Niels Hermes[#] and Robert Lensink

Department of Finance

Center of International Banking, Insurance and Finance (CIBIF)

University of Groningen

The Netherlands

Abstract:

This paper investigates the strategic monitoring behaviour within a group lending setting. We develop a theoretical model, showing that monitoring efforts of group members differ from each other in equilibrium, as a result of the asymmetry between these members in terms of the future profits they generate with their project. In particular, we show that the entrepreneur with the project that generates the highest future profits also puts in the highest monitoring effort. Moreover, monitoring efforts differ between group members due to free-riding: one member reduces her level of monitoring if the other increases her monitoring effort. This effect is also at play when we introduce a group leader in the model. The individual who becomes the group leader will supply more monitoring effort than in the benchmark case, because of the reduced per unit monitoring costs related to becoming the leader. We empirically test the model using data from a survey of microfinance in Eritrea and show that the group leader attaches more weight to future periods than non-leaders in group lending and that this may explain why a large part of total monitoring is put in by the leader.

JEL Classification: D82, G29, O16

Key Words: group lending, group leader, moral hazard, monitoring, Eritrea

[#] Corresponding author: Niels Hermes, Faculty of Management and Organization, University of Groningen, PO Box 800, 9700 AV Groningen, The Netherlands; telephone: +31-50-3634863; fax: +31-50-3637356; email: c.l.m.hermes@rug.nl

1. Introduction

Lack of access to credit is generally seen as one of the main reasons why many people in developing economies remain poor. Usually, the poor have no access to loans from the banking system, because they cannot put up acceptable collateral and/or because the costs for banks of screening and monitoring the activities of the poor, and of enforcing their contracts, are too high to make lending to this group profitable. Since the late 1970s, however, the poor in developing economies have increasingly gained access to small loans with the help of so-called microfinance programmes. Especially during the past ten years, these programmes have been introduced in many developing economies. Between December 1997 and December 2005 the number of microfinance institutions increased from 618 to 3,133. The number of people who received credit from these institutions rose from 13.5 million to 113.3 million (84 per cent of them being women) during the same period (Daley-Harris, 2006).

Many microfinance programs are characterized by so-called joint liability. With joint liability lending the group of borrowers is made responsible for the repayment of the loan; if one group member does not repay her loan, others may have to contribute so as to ensure repayment. In many cases, groups are small, consisting of 5-10 members. The broad consensus in the economic literature is that it mitigates problems of asymmetric information related to providing loans. Yet, most theoretical models on joint liability lending take a rather simple approach as to how group lending mitigates these problems. Basically, most models assume that all members monitor each other and that monitoring efforts of members are equal.

Usually, one of the members of the group is appointed to become the group leader, a position for which anyone from the group may volunteer. The group leader may have different tasks and the exact contents of these tasks may differ among group lending programs. Yet, the group leader usually is the intermediary between the group and the program staff, who regularly reports to the program's staff on the performance and sustainability of the group. Moreover, the group leader usually chairs group meetings, collects the install payments from group members and transfers them to the credit officer, visits group members regularly and discusses business and/or group related problems, and calls for extra group meetings if repayment problems occur. Again, depending on the characteristics of the group lending program, group leaders may or may not be paid for their activities.

Exisiting literature has hardly dealt with the specific role of the group leader as part of the group lending mechanism. Yet, based upon the above description, it seems reasonable to assume that in most cases the group leader plays a prominent role in the functioning of the group. Many questions remain unanswered, though, such as why someone wants to become

group leader, whether they contribute to mitigating moral hazard behavior and whether or not they help improving the repayment performance of groups. Whereas the latter two questions have been addressed empirically in two recently published papers (Hermes, Lensink and Mehrteab, 2005 and 2006), the first issue remains unresolved. Given the fact that the activities of the group leader are costly and assuming that she/he is not financially paid for these activities, the question arises why someone would volunteer to become group leader. We present a theoretical model that explains why this is the case. We also provide preliminary evidence supporting the main outcomes of the theoretical model.

The remainder of the paper is organised as follows. Section 2 briefly describes the main characteristics of existing models of joint liability lending. In sections 3-8 we provide a new theoretical framework analysing group interaction, particularly focusing on strategic behaviour of individual group members, as well as of the group leader. Section 3 describes the basic model for a group lending programme with three asymmetric borrowers. In section 4 we derive the condition stating that moral hazard is present if there is no peer monitoring. Section 5 presents the monitoring technology, both for the group leader and the other group members. Section 6 discusses the benchmark case in which there is no group leader. In section 7, we introduce a group leader and derive equilibrium monitoring levels for the case in which the most profitable entrepreneur is the leader, as well as for the case in which the second most profitable individual becomes the group leader. Section 8 endogenizes on the choice of group leadership. This is followed by a preliminary empirical test of the model in section 9. Section 10 concludes.

2. Joint liability lending

Generally speaking, microfinance programmes provide credit to the poor, either through joint liability group lending, or through individual-based lending. While the latter comes close to traditional banking, involving a direct relationship between the programme and an individual, the joint liability lending approach uses groups of borrowers to which loans are made. Currently, the majority of microfinance borrowers have access to loans through group lending programmes. According to one recent survey of a sample of microfinance programmes, only 16 per cent of these made use of so-called group lending to provide credit to the poor; yet, they served more than two thirds of all borrowers from the microfinance programmes included in the survey (Lapenu and Zeller, 2001).

With joint liability lending the group of borrowers is made responsible for the repayment of the loan, i.e. all group members are jointly liable. Thus, if one group member

does not repay her loan, others may have to contribute so as to ensure repayment. Non-repayment by the group means that all group members will be denied future access to loans from the programme. In this way, group lending creates incentives for individual group members to screen and monitor other members of the group and to enforce repayment in order to reduce the risk of having to contribute to the repayment of loans of others and to ensure access to future loans. Thus, joint liability group lending stimulates screening, monitoring and enforcement of contracts among borrowers, reducing or erasing the agency costs of the lender. Moreover, the group lending structure is also expected to be more effective in providing such activities as compared to the lender, because group members usually live close to each other and/or have social ties (also referred to as social capital in the existing literature). They are therefore better informed about each other's activities. Since joint liability group lending stimulates screening, monitoring and enforcement within the group, and since it improves the effectiveness of these activities due to geographical proximity and close social ties, repayment performance of group loans is expected to be high.

Several theoretical models confirm that joint liability group lending leads to more and more effective screening, monitoring and enforcement among group members. Some of these models explicitly focus on the properties of joint liability lending related to mitigating information asymmetries. For example, models by Stiglitz (1990) and Varian (1990), Banerjee et al. (1994), Armendáriz de Aghion (1999) and Chowdury (2005) explicitly deal with moral hazard and monitoring problems, showing how joint liability may help to solve these problems. Ghatak (1999 and 2000) and Gangopadhyay et al. (2005), among others, provide models focussing on adverse selection and screening. Some other models specifically discuss the role of social ties within group lending in improving repayment performance of groups. The work of Besley and Coate (1995) and Wydick (2001) fall into this category of models.

Despite the fact that there are quite some theoretical analyses explaining how joint liability group lending may solve problems of information asymmetry, there is hardly any model explicitly focusing on different types of interaction between group members and the consequences for individual behaviour. In particular, models do not pay attention to strategic behavior of individuals within a group. Existing theoretical models typically assume that the lending group consists of only two identical persons. In this setting, peer monitoring is necessarily mutual in order to make the joint liability contract work (Armendáriz de Aghion, 1999). However, if the group consists of more than two members, the monitoring effort of an

individual member may well depend on the monitoring effort of her peers, giving rise to the possibility of strategic behavior.

The model of Armendáriz de Aghion (1999) provides the first attempt to study the monitoring behavior of individuals in a lending group with more than two borrowers. In her set up, the group consists of three individuals that all can monitor each other to see whether one is *unable* or *unwilling* to meet her debt repayment; or stated differently whether or not a group member defaults strategically. The model focuses on the partial equilibrium in which one of the group members is monitored by the other two. The two monitoring individuals are assumed to be symmetric, leading to a unique symmetric equilibrium in which both monitors put in an equal level of monitoring.

Yet, in reality interests of group members may diverge, which may lead to asymmetric monitoring incentives. One clear example of this is the situation in which expected future profits are different for different group members. If this is the case, members have different interests in having access to future loans from the program. This in turn gives members different incentives to monitor the other group members. These different incentives among individuals to monitor each other may also explain why some individuals volunteer to become a group leader.

The model we present in the following sections makes use of the idea that group members may strategically behave when it comes to monitoring each other to explain why individuals volunteer for being the group leader, even if this is a costly task. In particular, we investigate strategic decisions concerning peer monitoring in a group lending program with three borrowers. We start by assuming that the lending group consists of three asymmetric entrepreneurs and that these entrepreneurs only differ from each other with respect to the future profits their projects generate. It is also assumed that the two individuals with the highest future payoffs put high effort in their projects to increase the probability that the loan is continued. The borrower with the project that has lowest future profitability shirks on putting effort in her project if she is not monitored, because the higher disutility when supplying more effort dominates the higher expected (future) profits due to the increased probability that the loan is continued. This thus gives the other two borrowers an incentive to monitor. In the benchmark model, in which there is no group leader, we obtain that in equilibrium the individual with the highest future payoffs provides the highest level of peer monitoring. This is due to two effects. First, the borrower with the highest expected future profits cares most about the continuation of the loan, which gives her the highest incentive to monitor. Second, because both monitors take into account each other's optimal monitoring

strategies, the second-most profitable entrepreneur reduces her monitoring effort as a result of the high monitoring effort provided by the most profitable borrower. Vice versa, given the lower level of peer monitoring of the second-most profitable entrepreneur, the most profitable borrower increases her monitoring effort even more. Analogously to quantity in a strategic duopoly, monitoring effort levels are strategic substitutes.

Next, we introduce the presence of a group leader. This means that one of the individuals in the group has to become the group leader, or otherwise the group cannot be formed. We argue that, despite the obligation to fulfil various tasks, being a group leader can be beneficial, because the leader has extra monitoring options that the non-leaders do not have. For example, a group leader chairs group meetings, plans meetings when there are repayment problems, etc. Assuming a convex monitoring cost function, these extra monitoring options reduce the *per unit* costs of monitoring effort.

We first show that in the presence of a group leader, and assuming that it is exogenously determined who will be the leader, the equilibrium monitoring effort of the borrower who now is the leader is higher than in the benchmark, while the level of peer monitoring of the non-leader is lower. This is due to the fact that monitoring is a strategic substitute. Second, we find that in the case in which the choice of group leadership is endogenous, the individual with the highest future payoffs under certain circumstances volunteers to be the group leader, even if she has to incur a disutility of performing the cumbersome tasks that comes with the leadership. Due to the more efficient monitoring, the leader exerts more monitoring effort on the individual with the least profitable project to increase the probability that the loan will be continued.

3. The basic model

We consider three risk-neutral entrepreneurs who have the option to invest in a risky project, but need funds from a risk-neutral outside investor (henceforth: the bank) to finance the investment project. These entrepreneurs are denoted by A, B, and C and have initially no wealth. The funds needed by each entrepreneur are normalized to one, and the debt repayments, denoted by d^G, are exogenously given in such a way that the expected profits of the bank are always zero or positive in the remainder of the analysis.[1] Furthermore, A, B, and

[1] The assumption that d^G is exogenously given implies that the bank does not maximize profits. We assume that the bank breaks even if B and C put in high effort and A provides low effort, which is the case if there is no

C can only obtain funds if they form a lending group together. The group must have one leader, otherwise the group will not be formed and the projects are cancelled.

In the first period the project is carried out, the expected payoff of a project only depends on the effort supplied by the entrepreneur who undertakes this specific project. Let p_j be the probability that the project will be a success with effort level $j, j = H, L$ and $p_H > p_L$. The difference between these probabilities is given by $\Delta p = p_H - p_L$. In this context, j is the effort level of the project-specific entrepreneur and is therefore the single determinant of the probability of success. Next, $R_1 > 0$ is the first-period payoff of the project when the project succeeds and $R_1 = 0$ is the output when the project is not successful. This first-period payoff is equal for all three entrepreneurs. The expected returns for the three group members in the first period become $\mu_j = p_j R_1$, with $\Delta\mu = \Delta p R_1$. However, putting in high effort gives the entrepreneurs more disutility than putting in low effort. We monetize this disutility from providing effort by defining a parameter $c_j, j = H, L$ and $\Delta c = c_H - c_L > 0$.

If each borrower repays her debt, all group members obtain a new loan, which is needed to continue the project in the following period. If one or more group members default on their debt, the non-defaulting member has to repay for them, otherwise the group lending program is stopped. If the projects are continued, the payoffs in the next period, denoted by R_2^i, $i, i = A, B, C$ are not the same across group members. Moreover, entrepreneurs B and C cannot perfectly observe the second-period payoffs of A, but do know that A's payoffs in the second period are randomly distributed on the interval $[0, M]$. It is assumed that A herself exactly knows what her second-period payoffs are. For ease of exposition and because our analysis is concentrated on B and C monitoring A, we assume that the payoffs in the second period of B and C are perfectly observable by all and are equal to $R_2^B = 2M$ and $R_2^C = 3M$, respectively. This means that in the second period, C's project is always more profitable than B's project and therefore, it is in the best interest of C that the loan is continued.[2]

Next, it is assumed that B and C always put in high effort, independently of the actions of the other group members and moreover, it is assumed that A always shirks on putting in

---

monitoring. This boils down to $d^G = 1/\left(1-(1-p_H)^2(1-p_L)\right)$. As we will show, there are situations in which A does provide high effort, resulting in positive expected profits for the bank. Although we are aware of the fact that the zero-profit condition for the investor is a standard assumption in the literature, adopting this would heavily complicate our analysis, without yielding important additional insights. In this light, see Besley and Coate (1995) and Chowdhury (2005), who also take the debt claim as an exogenous parameter.

[2] Because it does not change the analysis drastically, we consider for simplicity that the returns in the second period are independent of the effort level.

effort if she is not monitored. The conditions for these assumptions to hold are stated in the next section. The latter assumption means that the moral hazard problem is present, giving group members B and C a reason to monitor member A. A monitor imposes a social cost Z on someone who is caught shirking. The probability that someone who monitors catches a shirking peer is given by γ_i. The monitor itself can choose this probability and will always choose $\gamma_i = 1$ if choosing so does not come at a cost, because this gives the maximal threat of a social sanction to the peer who is monitored.[3] However, we will assume that monitoring is costly, which means that setting a higher probability of detecting a shirking group member also means higher costs. The crucial aspect in the analysis is the assumption that the *per unit* monitoring costs are lower for the group leader than for the non-leaders in the group, which may work as an incentive to become the group leader. In the next section, we treat this issue in more detail.

The timing of the model is as follows: at $t = 0,$ the entrepreneurs form a group, decide on who becomes the group leader, and borrow the funds from the bank. Moreover, each entrepreneur chooses the effort to put in the project and the monitoring effort. At $t = 1,$ payoffs are realized and the total debt claim is paid off if at least one entrepreneur is successful. The bank continues the loan only if all loans are repaid. A social sanction Z is imposed if someone is caught providing low effort. At $t = 2,$ the entrepreneurs realize a certain payoff R_2^i in case the projects were continued at $t = 1$ and a zero payoff otherwise. Hereafter, the world ends.

4. Moral hazard

First, we show under what condition the moral hazard problem exists in this model. In this context, moral hazard occurs if entrepreneur A provides low effort, given that entrepreneurs B and C do not monitor A. This gives rise for B and C to monitor A's behavior, because low effort by A reduces their expected profits. In order to derive the condition for the existence of moral hazard, we determine the optimal choices for entrepreneur A. As we have already assumed, B and C will always choose to provide high effort, so that the total payoffs for A equal

[3] We assume that the entrepreneur who is monitored can perfectly observe what the probability is that she is caught if she puts in low effort.

$$\pi_j^A \begin{cases} R_1 - d^G - c_j + R_2^A & \textit{with probability} & p_j p_H^2 \\ R_1 - 1\tfrac{1}{2} d^G - c_j + R_2^A & \textit{with probability} & 2p_j p_H (1-p_H) \\ R_1 - 3d^G - c_j + R_2^A & \textit{with probability} & p_j (1-p_H)^2 \\ -c_j + R_2^A & \textit{with probability} & (2-p_H)(1-p_j) p_H \\ -c_j & \textit{with probability} & (1-p_j)(1-p_H)^2 \end{cases}$$

The first element of π_j^A gives the expected profits for A when all projects turn out to be successful. Note that in this situation, A only has to repay her own debt claim and joint liability plays no role in this case. For the following case, A does have to repay for one of her peers, because this peer was not successful, while A (and B or C) was. We assume that each of the successful ones come up with half of the debt claim the bank has on the defaulting peer. In the third case, A even has to pay for both peers, because she was the only one who had a positive payoff. The fourth element gives profits if A's project failed, but at least one of her peers is able to repay for her. Notice that although A does not obtain any profits in the first period, the second-period profits are obtained due to the joint-liability structure of the loan. In the last case, none of the entrepreneurs were successful, which results in that the loan is stopped at $t = 1$ and second-period profits cannot be obtained. From this, we get that the expected payoff for entrepreneur A flowing from the project is given by

$$\begin{aligned} E\pi_j^A(jHH) = \mu_j + [p_j p_H^2 + 2p_H - 2p_j p_H - p_H^2 + p_j] R_2^A \\ - [p_H^2 + 3(1-p_H)] p_j d^G - c_j \,. \end{aligned} \tag{1}$$

To be sure that the moral hazard problem is present, we assume throughout the paper that

Assumption 1. $2M \geq \dfrac{\Delta c + \Delta p\left(\beta d^G - R_1\right)}{\alpha \Delta p} \geq M$,

with $\alpha \equiv p_H^2 - 2p_H + 1$ and $\beta \equiv p_H^2 + 3(1-p_H)$.

Assumption 1 assures that A always puts in low effort if she is not monitored. Therefore, B and C have an incentive to monitor A, given that the social cost that can be imposed on A if she is caught shirking is high enough. Moreover, from assumption 1 we know that B and C always supply high effort, because they both have second-period profits at least as high as $2M$, which is higher than the benefits from providing low effort.

5. Monitoring technology

In the previous section, we stated that group members B and C always fully monitor if monitoring is costless. However, this assumption is not realistic, which is why we only consider the case where monitoring is costly. To see why someone who monitors others incurs costs, notice that monitoring requires putting in efforts, devouring (a substantial amount of) resources and time the group member otherwise could have spent on her own project. As we shall demonstrate below, the crucial aspect in our model is that the group leader has a different monitoring cost function than the non-leaders within the group. More formally, we state that the monitoring cost function of a non-leader in the group is given by

$$c(\gamma_i) = \frac{\kappa}{2}(\gamma_i)^2, \qquad \gamma_i \leq 1. \tag{2}$$

while for the a leader the monitoring cost function is denoted by

$$c^{GL}(\gamma_i) = \frac{\kappa}{4}(\gamma_i)^2, \qquad \gamma_i \leq 1, \tag{3}$$

where γ_i is the individual monitoring effort of entrepreneur i, $i = B, C$, and κ is an efficiency parameter. It is assumed that this parameter is the same for B and C. From this, we get that in our analysis the per-unit monitoring costs are lower for the group leader than for the non-leaders.

To justify the different cost functions for the leader and non-leader, we argue the following: it is fair to say that the group leader has at least all the monitoring options the others have, and very likely, has some extra options the others do not have. As was explained above, a group leader chairs group meetings, plans meetings when there are repayment problems, etc. Moreover, it is assumed that the additional monitoring options available to the

group leader are as effective as the options all group members (*i.e.* the leader and the non-leaders) have, which means that these additional options can be treated as a duplication of the monitoring possibilities of the non-leaders. Next, we argue that the monitoring options are subject to a decline in marginal effectiveness, hence the quadratic term in the cost functions. Solving the simple cost-minimization problem of the group leader shows that the leader divides her monitoring effort equally over the different options, which results in the cost function given by equation (3).

In the next section we first discuss the case in which the group does not have a group leader and all group members have the same monitoring cost functions. The results we obtain from this case are mainly used as a benchmark, which we compare with the results we get if we model the presence of the group leader.

6. Monitoring without group leadership

In case there is no group leader, B and C have the same cost function which is given by equation (2). To determine the optimal monitoring efforts, we not only have to know the cost structure of monitoring, but also the benefits of it. Clearly, the benefits of monitoring are that the probability that A will supply high effort increases, given that the monitor can impose a high enough social sanction on A if A is caught shirking. Note that the probability that A is monitored effectively by at least one peer equals $\Gamma_A = 1-(1-\gamma_B)(1-\gamma_C)$, which means that B's decision to monitor clearly depends on C's monitoring decision and vice versa. Given that they both provide high effort, the extra profits B and C make when B supplies high effort equal

$$\Delta E\pi_i = \Delta p\left(\left(1\tfrac{1}{2} - p_H\right)p_H d^G + (1-p_H)^2 R_2^i\right), \qquad (4)$$

with $i = B, C$.

From this, we can see that the extra profits B and C make when A provides high effort equal the difference in probability of success times a term that both depends on joint liability and second-period profits. Remember that we assumed that the second-period profits are always higher for C than for B. This means that B and C are asymmetric in the sense that they have a different valuation for A's effort level. As we will see below, this results in an asymmetric

equilibrium. The extra profits B and C make if A puts in high effort have to be multiplied with the change in probability that A provides high effort, to come to the expected profits of monitoring. Therefore, the net expected profits of supplying monitoring effort γ_i equal

$$\Pi_i(\gamma_i) = P\left(R_2^A \geq \frac{\Delta c + \Delta p\left(\beta d^G - R_1\right) - Z\Gamma_A(\gamma_i)}{\alpha \Delta p} \right) \Delta E\pi_i - \frac{\kappa}{2}(\gamma_i)^2, \qquad (5)$$

with $i = B, C$.

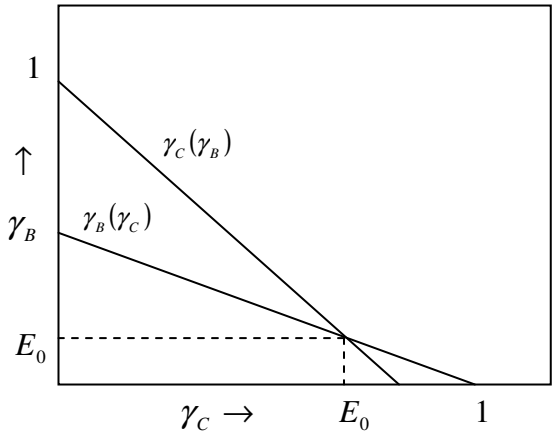
For the sake of exposition, we use $x \equiv \left(\left(1\,1/2 - p_H\right)p_H d^G + 2(1-p_H)^2 M\right)/M$ and $y \equiv \left(\left(1\,1/2 - p_H\right)p_H d^G + 3(1-p_H)^2 M\right)/M$ in the remainder of the analysis. Maximizing expected profits with respect to monitoring efforts yields first-order conditions[4]

$$\gamma_B = \frac{xZ}{\alpha\kappa}(1-\gamma_C)$$
$$\gamma_C = \frac{yZ}{\alpha\kappa}(1-\gamma_B). \qquad (6)$$

These first-order conditions can be seen as reaction functions, as both entrepreneurs make their monitoring decision dependent on the monitoring level of the other. Moreover, the levels of monitoring effort are strategic substitutes in the sense that an entrepreneur reduces her monitoring effort if the other increases her effort (see also figure 1). We can then formulate the following proposition:

[4] We assume $\alpha\kappa > yZ$, which assures us that $0 < \gamma_B < 1$ and $0 < \gamma_C < 1$. This means that we only have to consider interior solutions

Figure 1: Reaction curves for monitoring effort, equilibrium at E_0



Proposition 1. Given that no one in the group is the leader and that entrepreneurs simultaneously decide on their monitoring effort, the entrepreneur with the highest second-period payoffs puts in the highest monitoring effort.

Proof. The proof is fairly simple. Substituting the first-order conditions into each other gives equilibrium monitoring efforts $\gamma_B = \frac{(\alpha\kappa - yZ)xZ}{(\alpha\kappa)^2 - xyZ^2}$ and $\gamma_C = \frac{(\alpha\kappa - xZ)yZ}{(\alpha\kappa)^2 - xyZ^2}$. We get that $\gamma_C > \gamma_B$ if $x < y$, which holds by assumption. This gives that the entrepreneur with the highest second-period payoffs, which is C, puts in more monitoring effort than the one with the lower second-period payoffs, which is B. QED.

This result is due to two different causes. First, entrepreneur C has higher second-period payoffs, which means that she has more interest in the continuation of the loan than B and benefits more from the monitoring efforts. Secondly, because B knows that it is most beneficial for C that A is monitored effectively, she also realizes that C puts in a substantial amount of monitoring effort. This reduces the incentive for B to supply monitoring effort.

7. Monitoring with group leadership

In the above analysis, we abstracted from the issue of group leadership and assumed that the group did not need a group leader. However, in reality we often see that a lending group needs a leader, who is the intermediary between the outside investor and the group itself. As we already discussed, a leader is likely to have more monitoring options than the non-leaders,

which reduces per-unit monitoring costs. If this is the case, it may be beneficial for an entrepreneur to become the group leader, even if being a group leader means one has to perform some (other than monitoring) cumbersome tasks. The (utility) loss of executing these tasks is modelled by introducing some fixed costs F that the group leader has to incur. These fixed costs will be introduced in the model in the next section, where we endogenize the choice to become the leader. In this section, however, we exogenously determine who will be the group leader.

7.1. Monitoring with C as group leader

Suppose that entrepreneur *C* is the group leader. In this case the monitoring cost function of C is given by equation (3), while the monitoring cost function of B remains to be given by equation (2). The expected profits of monitoring equal

$$\Pi_B\left(\gamma_B^{GLC}\right) = P\left(R_2^A \geq \frac{\Delta c + \Delta p\left(\beta d^G - R_1\right) - Z\Gamma_A\left(\gamma_B^{GLC}\right)}{\alpha\Delta p}\right)\Delta E\pi_B - \frac{\kappa}{2}\left(\gamma_B^{GLC}\right)^2$$

$$\Pi_i\left(\gamma_C^{GLC}\right) = P\left(R_2^A \geq \frac{\Delta c + \Delta p\left(\beta d^G - R_1\right) - Z\Gamma_A\left(\gamma_C^{GLC}\right)}{\alpha\Delta p}\right)\Delta E\pi_C - \frac{\kappa}{4}\left(\gamma_C^{GLC}\right)^2, \qquad (7)$$

where γ_B^{GLC} and γ_C^{GLC} are the monitoring efforts of respectively B and C when entrepreneur C is the leader. The first-order conditions boil down to[5]

$$\gamma_B^{GLC} = \frac{xZ}{\alpha\kappa}\left(1-\gamma_C\right)$$

$$\gamma_C^{GLC} = \frac{2yZ}{\alpha\kappa}\left(1-\gamma_B\right). \qquad (8)$$

We can formulate the following proposition.

Proposition 2. Given that the entrepreneur with the highest second-period profits becomes the group leader and that the entrepreneurs simultaneously choose their monitoring level, the

[5] In this situation, we assume $\alpha\kappa > 2yZ$, so that we again only consider interior solutions.

leader now monitors more than in the case where there is no leader, while the non-leader monitors less compared to the situation in which there is no group leader.

Proof. From equation (8), we obtain equilibrium monitoring levels equal to $\gamma_B^{GLC} = \frac{(\alpha\kappa - 2yZ)xZ}{(\alpha\kappa)^2 - 2xyZ^2}$ and $\gamma_C^{GLC} = \frac{2(\alpha\kappa - xZ)yZ}{(\alpha\kappa)^2 - 2xyZ^2}$. Comparing these outcomes with the equilibrium levels when the group has no leader, we see that $\gamma_B^{GLC} < \gamma_B$ and $\gamma_C^{GLC} > \gamma_C$ if $\alpha\kappa > xZ$, which holds by assumption. QED.

The intuition behind this is as follows: due to the lower monitoring costs and given a certain monitoring effort of B, C wants to monitor A more, i.e. her reaction function shifts outwards. Anticipating on this, B supplies less monitoring effort than in the case where there is no leader. Notice that this is the result of the monitoring efforts being strategic substitutes (see also figure 2).

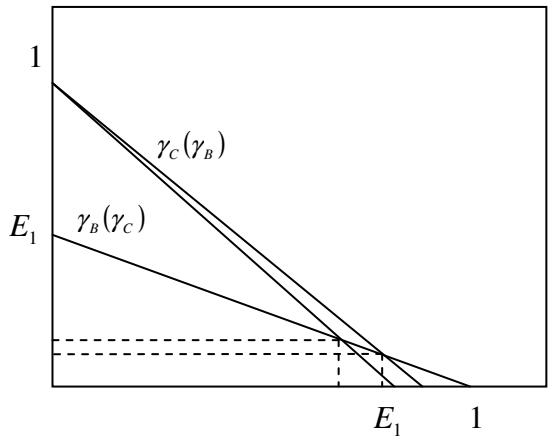
Although the *per unit* costs of monitoring for C are lower in this case than if there is no group leader, it can be shown that the *total* monitoring costs of C are now higher due to the higher level of monitoring effort C puts in.[6] One may think that given this result, C is never willing to be the leader. Notice, however, that because of the different monitoring levels in both cases the probability that A is effectively monitored (and therefore the probability that A provides high effort) also differs between the cases. We get that if $\alpha\kappa > xyZ$, this probability is higher in the case where C is the leader than when there is no leader in the group. Later, when we endogenize the choice of becoming the leader, we will be more specific about the equilibrium costs and benefits for C when she is the leader.

7.2. Monitoring with B as group leader

If B is the group leader, we can perform a similar kind of analysis as if C was the leader, but now with the monitoring cost function for B given by equation (3), while C's monitoring cost function is stated by equation (2). We then come to the following proposition.

[6] More formally, the monitoring costs for C in the case where there is no group leader equal $C(\gamma_C) = \kappa/2\left(\frac{(\alpha\kappa - xZ)yZ}{(\alpha\kappa)^2 - xyZ^2}\right)^2$, while C's monitoring costs are $C(\gamma_C^{GL}) = \kappa/4\left(\frac{2(\alpha\kappa - xZ)yZ}{(\alpha\kappa)^2 - 2xyZ^2}\right)^2$ if she herself is the group leader. The former is smaller than the latter if $(\alpha\kappa)^2(\sqrt{2}-1) + xyZ^2(2-\sqrt{2}) > 0$, which always holds.

Figure 2: reaction curves when C is the group leader, equilibrium at E_1



Proposition 3. If the entrepreneur with the lower second-period payoffs is the group leader, her monitoring effort is higher than in the case where there is no group leader, while the monitoring effort of the entrepreneur with the highest profits in the second period, i.e. the non-leader in this situation, is now lower. Moreover, the leader may monitor more or less than the non-leader, depending on the debt claim of the bank and the difference between the profits both entrepreneurs can generate in the second period. For our choice of second-period payoffs of B and C, $R_B^2 = 2M$ and $R_C^2 = 3M$, the leader (B) puts in more monitoring effort than the entrepreneur with the highest second-period payoffs (C).

Proof. Again, from the first-order conditions we obtain equilibrium monitoring levels of B and C equal to $\gamma_B^{GLB} = \frac{2(\alpha\kappa - yZ)xZ}{(\alpha\kappa)^2 - 2xyZ^2}$ and $\gamma_C^{GLB} = \frac{(\alpha\kappa - 2xZ)yZ}{(\alpha\kappa)^2 - 2xyZ^2}$, respectively. Comparing these levels with the equilibrium levels in the case there is no group leader gives that B monitors more and C monitors less if $\alpha\kappa > yZ$, which holds by assumption. Next, the monitoring level of B is higher than the level of C if $2x > y$, or if $\left(1\tfrac{1}{2} - p_H\right)p_H d^G + (1-p_H)^2\left(2R_B^2 - R_C^2\right) > 0$. Substituting the exogenously given second-period returns into this condition gives $\left(1\tfrac{1}{2} - p_H\right)p_H d^G + (1-p_H)^2 M > 0$, which yields that for these payoffs B monitors more than C. However, if the difference in second-period payoffs is high and the debt claim is low, it may be that $2x < y$, so that in this case the leader monitors less than the non-leader. QED.

Again, it can be shown that the *total* monitoring costs of the group leader are higher than in the case where there is no leader.

8. Endogenous choice of group leadership

In the above analysis it was exogenously given which entrepreneur would be the leader. However, if the group members are free to choose whether they will lead the group, in equilibrium all entrepreneurs follow their best strategy. We only focus on equilibria in which entrepreneur B and C are willing to become the group leader, otherwise there would be no leader and the group would not exist.[7] We then come to the following proposition.

Proposition 4. If the entrepreneur with the highest second-period payoffs volunteers to be the group leader, the entrepreneur with the lower profits in the second period always agrees on this. Therefore, we have a self-enforcing equilibrium in which the former will always be the group leader.

Proof. To see why it is always more profitable for B that C is the group leader instead of herself, notice that we already obtained that the total monitoring costs for B are higher if she herself is the leader than if C leads the group. Moreover, on the benefit side, the probability that A is monitored effectively is higher in case C takes the leadership than in the situation where B is the leader if $\left(1-\gamma_B^{GLC}\right)\left(1-\gamma_C^{GLC}\right)<\left(1-\gamma_B^{GLB}\right)\left(1-\gamma_C^{GLB}\right)$. This condition is always satisfied given that $y > x$. Concluding, for B the costs are higher while the benefits are lower if B instead of C is the group leader, which makes it unprofitable for B to be the leader if C volunteers to lead the group. QED.

Now we have to determine under which condition entrepreneur C is willing to be the group leader. In contrast to B, there are two opposing effects for C if she is the group leader. On the one hand, being the leader means higher monitoring costs, but on the other hand, the probability of effective monitoring under C's leadership is higher.

[7] Here, we assume that F is high enough, so that it is never profitable for A to be the leader, even if the other two are not willing to lead the group. Moreover, we assume that F is low enough to ensure that B and C want to take the leadership if otherwise the group would not exist.

Proposition 5. If $y > \frac{\alpha^2\kappa^3 x}{\left(\alpha\kappa - \frac{1}{2}\right)(\alpha\kappa)^2 + (xZ)^2}$, entrepreneur C volunteers to lead the group.

Proof. As we already pointed out, if C leads the group instead of B the probability that A is monitored effectively is higher. Therefore, the extra benefits C makes by being the leader equal $\Delta\Pi_C = \Pi_C^{GLC} - \Pi_C^{GLB} = \frac{\alpha^2\kappa^3 yZ^2(y-x)}{\left((\alpha\kappa)^2 - 2xyZ^2\right)^2}$. However, being the leader means also higher total monitoring costs for C and the extra costs for C of being group leader equals $\Delta C_C = C\left(\gamma_C^{GLC}\right) - C\left(\gamma_C^{GLB}\right) = \frac{\left(\frac{1}{2}(\alpha\kappa)^2 - (xZ)^2\right)(yZ)^2}{\left((\alpha\kappa)^2 - 2xyZ^2\right)^2}$. This means that entrepreneur C volunteers to be the group leader if $\Delta\Pi - \Delta C > 0$, or if $y > \frac{\alpha^2\kappa^3 x}{\left(\alpha\kappa - \frac{1}{2}\right)(\alpha\kappa)^2 + (xZ)^2}$. QED.

Figure 3 illustrates the extra profits entrepreneur C makes if she instead of B is the leader for parameter values $p_L = 0.2,\ p_H = 0.5, \kappa = 8,\ and\ 0 \le M \le 10$. For small values of M, the condition $\alpha\kappa > 2yZ$ is violated . For the feasible range of M we see that the extra profits decrease as M increases. The intuition behind this result is that as M becomes bigger, the relative difference between the profitability of B's project and C's project, and therefore the difference in monitoring effort provided, becomes smaller. This means that the probability that A is monitored effectively is not much higher in case C is the leader than if B leads the group.

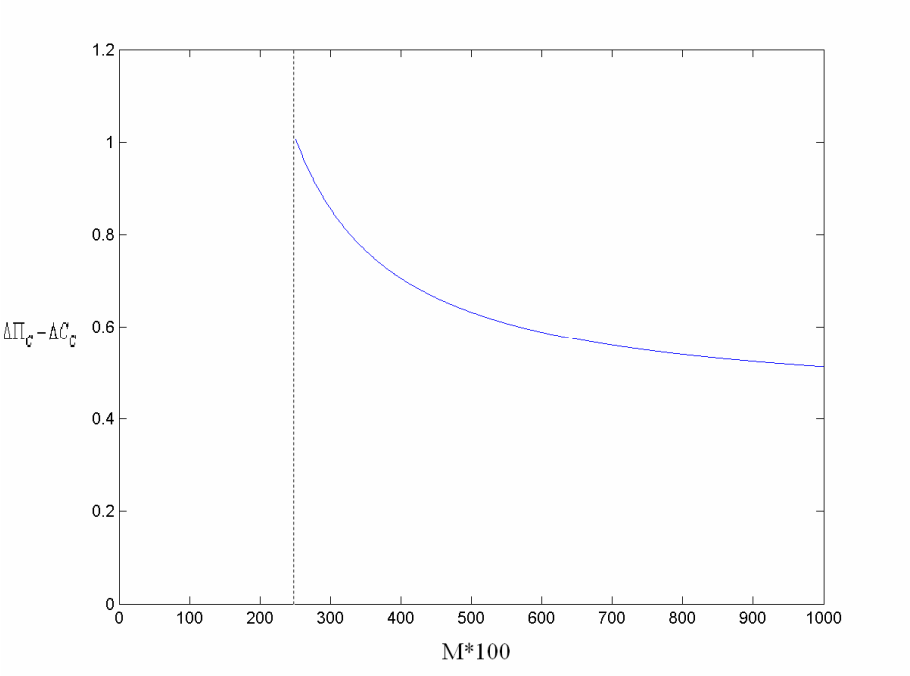
The main conclusions from the theoretical model is that the group member with the highest expected second-period payoff has the strongest incentive to volunteer becoming the group leader, since the additional returns from increasing efforts to monitor A's behavior are higher, taking into account the fact that B will lower monitoring efforts due to stretagic behavior. These conclusions provide at least two testable hypotheses:

(1) Group members with projects that generate high future profits will volunteer to become the group leader. For these members future access to loans is more important, which means that they value future access to loans higher than other group members.

(2) Montoring efforts of other group members will be reduced in the presence of a group leader as compared to the situation where there is no group leader.

In the next section, we test both hypotheses using data from a questionnaire among individuals participating in two joint laibility programs in Eritrea.

Figure 3: C's extra profits of being the leader if $p_L = 0.2$, $p_H = 0.5$, $\kappa = 8$, *and* $0 \le M \le 10$



9. The role of the group leader: Empirical evidence from Eritrea

In the year 2000 (the year in which we conducted our survey) there were two group-lending programs operating in Eritrea. The Saving and Micro Credit program (SMCP) is active since 1996 and is part of the Eritrean Community Development Fund (ECDF), a government related fund. The funding for this program comes from the Eritrean government, the World Bank and from grants from a number of individual donor countries. The Southern Zone Saving and Credit Scheme (SZSCS) started in 1994 and was launched by the Agency for Co-operation and Research in Development (ACORD), a British NGO. SMCP has its activities all over the country, whereas SZSCS concentrates its efforts in the southern part of Eritrea.

The activities and organization of both programs are very similar. They both are active in rural as well as in urban areas. The borrowers in both programs are active as retailers, farmers, or small-scale producers. Both programs are set up along the lines of the Grameen Bank model. Groups are formed through self-selection; they consist of 3-7 members. After a group is accepted by one of the two programs, the group has to select a group leader. This

selection is random, which means that in principle the group can select anyone of its members and that any member can volunteer to become the leader. The group leader is the intermediary between the group and the program staff (i.e. the program's credit officer and/or the village credit committee or bank). He/she has to regularly report to the program's staff on the performance and sustainability of the group. Moreover, he/she has to chair group meetings, collect the install payments from group members and transfer them to the credit officer, visit group members regularly and discusses business and/or group related problems, and call for extra group meetings if repayment problems occur. Based on this description of tasks, we conclude that the group leader plays a prominent role in the functioning of the group. Being a group leader is a voluntary activity; it does not generate any (financial) remuneration.

During 2000 we conducted a survey among 102 groups, of which 56 were in SMCP and 46 were in SZSCS. Most of these groups were based in small villages and secondary towns of Eritrea. In the survey we asked questions about the socio-economic characteristics of the group members, as well as about the saving and repayment performance of individual group members. In addition, we included questions on the group formation process, the existence of social ties, and on processes of screening, monitoring and enforcement within groups. From each group we selected the group leader and one or more other members to answer the questions. Part of the questions was submitted to both the group leader and the other member(s) of each group; another part of the questions was specifically asked to the group leader.

Through the questionnaire we obtained information from 351 group members, of whom 102 were group leaders. Of the total sample of group members, 167 were participating in the SZSCS program and 184 in the SMCP program. Within the sample, 196 borrowers were females (56 per cent) and 155 were males. The majority (68 per cent) of the respondents had no or only primary education. The average monthly income of group members was approximately USD75. Trade (63 per cent) and farming (17 per cent) were the main occupations of group members; many of them usually had two (or more) occupations at the same time. On average groups were composed of 4.5 members, with a median of 4, ranging from a minimum of three to a maximum of seven members. The amount of loan cycles (or loan rounds) groups had completed up to the interview ranged from a minimum of two to a maximum of seven with an average of 3.6 cycles. Group loans ranged from USD54 to USD607 with mean and median loan size of USD282 and USD250, respectively. Loan terms varied from three to 24 months. Group members mainly used the loans for working capital purposes. Most respondents (337) had never even applied for a bank loan. Of the total sample,

17 per cent of the group members responded they have had repayment problems in the past at least once. Of the 102 group leaders, 46 were in a group in the SZSCS program and 56 in a group of the SMCP program; 54 of them were males (53 per cent) and 48 were females. Group leaders income was similar (USD72) to the average income level of all group members in the sample. They were also very similar to the average group member in terms of occupation: 61 per cent of them were active in trade, whereas 15 per cent were active in farming.

The survey allows us to investigate the first of the two hypothese mentioned above, i.e. why an individual volunteers to become group leader. In the survey we have information on several characteristics of group members among which are standard variable such as age, sex, education, etc. Of particular interest for our analysis in this paper, however, is a variable that indicates the value a group member attaches to having access to loans from the credit program in the future, ranging from 1 (= very high value) to 4 (= very low value). This variable is called *VFACCESS*. Group members that value future access to loans higher than other members are expected to have projects that generate high future profits and that they therefore are more willing to volunteer becoming the group leader. If this is true, we expect to find a negative correlation between being a group leader and the value of *VFACCESS* (negative because of the way this variable has been measured).

To test the above hypothesis of the negative relationship between being the group leader and *VFACCESS*, we set up the following empirical model. The dependent variable is a dummy variable that takes a value of 1 in case a group member is the leader and has the vlaue of 0 otherwise. Our empirical predicts when someone is group leader and uses a number of personal characteristics as independents. In the analysis, we use a probit estimator. Next to *VFACCESS* we use the following list of independent variables:

- *AGE* = age of the group member (years);
- *GENDER* = dummy variable; 1 if the group member is a male, 0 if woman;
- *EDUCATION* = the educational background of the group member, ranging from 1 (= illiterate) to 4 (= secondary schooling);
- *MOSLIM* = dummy variable; 1 if the group member is a Moslem, 0 otehrwise;
- *MARRIED* = dummy variable: 1 if the group member is married, 0 otherwise;
- *TRADER* = dummy variable; 1 if the grop member is a trader, 0 otherwise;
- *FARMER* = dummy variable; 1 if the group member is a farmer, 0 otherwise

Table 1 provides the results of the estimations. We analyse six different models. Model 1 (column [1]) is our base model, which only includes the main variable of interest, *VFACCESS*, as well as the *GENDER* variable. The reason for including this second variable is that from the description of the dataset (see above) we learned that in relative terms mos tof the group leaders are men. In the subsequent models (columns [2]-[6]) we add the other control variables one by one and leave those variables in the model that appear to have a statistically significant relationship with the dependent variable.

Table 1: Estimation results of the determinants of who is the group leader

	1	2	3	4	5	6
VFACCESS	**-0.270**	**-0.266**	**-0.265**	**-0.253**	**-0.273**	**-0.246**
	(0.035)	**(0.039)**	**(0.039)**	**(0.049)**	**(0.035)**	**(0.058)**
GENDER	**0.422**	**0.303**	**0.311**	0.225	**0.277**	**0.358**
	(0.009)	**(0.035)**	**(0.046)**	(0.144)	**(0.065)**	**(0.021)**
AGE	-0.011					
	(0.107)					
EDUCATION		**0.155**	**0.155**	**0.188**	**0.156**	**0.151**
		(0.050)	**(0.049)**	**(0.020)**	**(0.048)**	**(0.056)**
MARRIED			-0.024			
			(0.899)			
MOSLIM				0.260		
				(0.182)		
TRADER					-0.120	
					(0.444)	
FARMER						-0.223
						(0.296)
CONSTANT	0.123	-0.657	-0.642	-0.762	-0.563	-0.664
	(0.728)	(0.008)	(0.022)	(0.003)	(0.046)	(0.007)
Observations	351	351	351	351	351	351
Pseudo R^2	0.03	0.03	0.03	0.04	0.03	0.03

P-values between parantheses. Coefficients presented in the table are robust coefficients.

The results in table 1 show that our hypothesis is indeed supported. *VFACCESS* has a statistically significant negative relationship with the group leader dummy variable. Thus, group members who value access to loans higher have a higher probability of becoming group leader, which is in line with our theoretical model. Of the control variables *GENDER* and *EDUCATION* do also have explanatory power in our model. The rest of the control variables is statistically insignificant.

10. Conclusion

This paper has studied strategic monitoring behavior within a group lending setting, both for the case *with* and *without* the presence of a group leader. We have shown that in both cases the monitoring efforts of the borrowers in the group differ from each other in equilibrium, as a result of the asymmetry between these borrowers. The entrepreneur with the project that generates the highest future profits also puts in the highest monitoring effort. However, the difference between the effort levels of the two monitoring group members (B and C) is not only due to the difference in interest with respect to the continuation of the loan, but is also caused by a free-riding effect. Given that in our setting monitoring effort is a strategic substitute, the one borrower reduces her level of monitoring if the other increases her monitoring effort.

This effect is also at play when we introduce a group leader in the model. The individual who becomes the group leader will supply more monitoring effort than in the benchmark case, because of the reduced per unit monitoring costs. As a consequence, the non-leader free-rides on the higher level of monitoring of the leader and reduces her monitoring effort. We also obtained that in equilibrium, the *total* monitoring costs of the leader are higher than in the benchmark, even if the *per unit* costs are lower. Still, it can be beneficial for the most profitable entrepreneur to volunteer to be the group leader. The probability that the least profitable borrower is monitored effectively in that case is higher than if another group member is the leader. Therefore, the most profitable group member being the group leader maximizes the probability that the least profitable borrower puts high effort in her project. We point out that the results we have found are consistent with the empirical findings of Hermes *et al.* (2005). They conclude that for the case of Eritrea, a large part of total monitoring is put in by the group leader and moreover, the group leader attaches more weight to future periods than non-leaders.

The paper should be seen as a first attempt to model strategic behavior in a group lending setting and, using our basic framework, to explain the voluntary aspect of group leadership. However, we are aware of the partial equilibrium character of our model, which is the result of the assumption that the two most profitable entrepreneurs always put high effort in their projects. Relaxing this assumption would result in a more general equilibrium in which every individual monitors but is also monitored herself. Moreover, the timing of the model could be adjusted, so that borrowers do not simultaneously decide on their monitoring effort. Notice that this may in fact reflect reality, as non-leaders might have a tendency to

postpone the monitoring of peers until after the leader has monitored. This would make the group leader a Stackelberg leader in monitoring, which alters monitoring incentives within the group. Next, the entrepreneurs could be considered as being risk-averse instead of risk-neutral, which probably also changes the equilibrium levels of monitoring in the lending group. Our first idea is that with risk-averse entrepreneurs, the total monitoring effort will be higher, because individuals want to minimize the risk that they lose future payoffs. However, it is not clear how this results may be influenced when there is a group leader. This needs to be further researched. We leave this and other questions put forward above for further research.

References

Armendáriz de Aghion, B. (1999), "On the design of a credit agreement with peer monitoring", *Journal of Development Economics*, vol. 60, pp. 79-104.

Banerjee, A., T. Besley and T. Guinnane (1994) "Thy neighbor's keeper: the design of a credit cooperative with theory and a test", *Quarterly Journal of Economics*, vol. 109, pp. 491-515.

Besley , T. and S. Coate (1995), "Group lending, repayment schemes and social colleteral", *Journal of Development Economics*, vol. 46, pp.1-18.

Chowdhury, P.R. (2005), "Group-lending: sequential financing, lender monitoring and joint liability", *Journal of Development Economics*, vol. 77, pp. 415-439.

Daley-Harris, S. (2006), *State of the microcredit summit campaign report 2006*. Washington, DC: Microcredit summit campaign.

Gangopadhyay, S., M. Ghatak and R. Lensink (2005), "Joint liability lending and the peer selection effect", *The Economic Journal*, vol. 115, pp. 1005-1015.

Ghatak, M. (1999), "Group lending, local information and peer selection", *Journal of Development Economics*, vol. 60, pp. 27-50.

Ghatak, M. (2000), "Screening by the company you keep: joint liability lending and the peer selection effect", *The Economic Journal*, vol. 110, pp. 601-631.

Hermes, N., R. Lensink, and H.T. Mehrteab (2005), "Peer monitoring, social ties and moral hazard in group lending programmes: evidence from Eritrea", *World Development*, vol. 33, pp. 149-169.

Hermes, N., R. Lensink and H.T. Mehrteab (2006), "Does the group leader matter: the impact of monitoring activities and social ties of group leaders on the repayment performance of group-based lending in Eritrea", *African Development Review*, vol. 18, pp. 72-97.

Lapenu, C. and M. Zeller (2001), *Distribution, growth and performance of microfinance institutions in Africa, Asia and Latin America*, FCND discussion paper 114, Washington, DC: International Food Policy Research Institute (IFPRI).

Stiglitz, J. (1990), "Peer monitoring and credit markets", *World Bank Economic Review*, vol. 4, pp. 351-366.

Varian, H. (1990), "Monitoring agents with other agents", *Journal of Institutional and Theoretical Economics*, vol. 146, pp. 153-174.

Wydick, B. (2001), "Group lending under dynamic incentives as a borrower discipline device", *Review of Development Economics*, vol. 5, pp. 406-20.